MASTER OF SCIENCE
IN
INFORMATION TECHNOLOGY MANAGEMENT

ASSESSING THE POTENTIAL VALUE OF SEMANTIC WEB TECHNOLOGIES IN SUPPORT OF MILITARY OPERATIONS

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Recent military operations have redefined the way modern warfare is waged. In a deliberate effort to achieve and retain information dominance and decision superiority, many innovative technologies have emerged to assist the human warfighter. Unquestionably, these technologies have generated resounding successes on the battlefield, the likes of which have never been seen. With all the success, however, there are still areas for improvement, as the potential exists for further reducing already short sensor-to-shooter times.

The current World Wide Web (WWW) is largely a human-centric information space where humans exchange and interpret data. The Semantic Web (SWEB) is not a separate Web, but an extension of the current one in which content is given well-defined meaning, better enabling computers and people to work in cooperation. The result is the availability of the various backgrounds, experiences, and abilities of the contributing communities through the self-describing content populating the SWEB. This thesis assesses current SWEB technologies that promise to make disparate data sources machine interpretable for use in the construction of actionable knowledge with the intent of further reducing sensor to shooter times.

The adoption of the SWEB will quietly be realized and soon machines will prove to be of greater value to war fighting. When machines are able to interpret and process content before human interaction and analysis begins, their value will be further realized. This off-loading, or delegation, will produce faster sensor-to-shooter times and assist in achieving the speed required to achieve victory on any battlefield.

KEYWORDS: Semantic Web, XML, OWL, DAML, RDF, Knowledge Base, Database, Jini, Java, Agents, Ontologies, CoABS, Data Sources, Knowledge Generation, Jess

BUSINESS PROCESS REENGINEERING WITH KNOWLEDGE VALUE ADDED IN SUPPORT OF THE DEPARTMENT OF THE NAVY CHIEF INFORMATION OFFICER

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As the Department of Defense (DoD) begins transitioning to face the new global threats of terrorism, the new requirements of a refocused National Strategy will inherently force the DoD to transform its processes in support of the new National Strategy. In the next few years, the technology used to support the DoD will

continue to grow with the new demands, thus, the DoD will have achieved transformation at all levels enterprise-wide. "Transformation" or radical change has been occurring successfully in the corporate business world for over 25 years, and through this transformation the e-business technology has created an exponential growth in the knowledge producing information exchange systems. As the DoD looks to the e-business world for methodologies and solutions to capture this knowledge and manage it, it must also look for a surrogate definition of value or revenue that can be used as a measurement of return on the knowledge. This thesis will seek to define this value by presenting the e-business methodologies called Return on Knowledge (ROK), Knowledge Value Analysis (KVA), and Business Process Reengineering (BPR) by developing a web-enabled environment called the Transformation Information Technology Enabler (TITE) as a DoD transformation solution.

KEYWORDS: Transformation, Knowledge Value Added, KVA, Return on Knowledge, ROK, Business Process Reengineering, BPR, Information Technology Enabler, ITE, Transformation Information Technology Enabler, TITE

CORRELATION BETWEEN QUALITY MANAGEMENT METRIC AND PEOPLE CAPABILITY MATURITY MODEL

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The quality of software management in a development project is a major factor in determining the success of a project. The four main areas in which a software project manager can affect the outcome of a project are people management, requirements management, estimation/planning management, and risk management. People management is the management area with the highest influence on project success.

In this thesis, a quality management metric (QMM) was evaluated with respect to its conformance with an established people capability maturity model (P-CMM). The survey elements of the QMM were mapped to the processes described in the maturity model. The analysis indicates a high level of conformance of the QMM with the P-CMM. The results of applying the QMM can be used to characterize the quality of software management. Based on the correlation of QMM survey elements to processes of the maturity model, the results can then be used to identify processes that need improvement to increase the likelihood of program success.

Future work includes further refining and assessing the QMM. As new models in the field of software development management evolve, the QMM will need to be re-evaluated with respect to these new models.

KEYWORDS: Software Management, People Management, Quality Management Metric, QMM, People Capability Maturity Model

AN OPTIMIZATION OF THE BASIC SCHOOL MILITARY OCCUPATIONAL SKILL ASSIGNMENT PROCESS

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The reduction of attrition in the junior officer ranks has presented a constant challenge to manpower planners. The desire of an officer to remain on active duty is influenced by his or her satisfaction with their

military occupational skill. The assignment of MOS's to Marine lieutenants has essentially remained unchanged for the past 30 years.

This thesis presents an interdisciplinary solution to the problem of assigning Military Occupational Skills to lieutenants at The Basic School. The thesis captures the requirements analysis, testing, implementation, operation, and maintenance of two-tier decision support system architecture. This thesis presents an alternative business process centered on "MyMOS." MyMOS is a web-based decision support system for use by the lieutenants and staff of The Basic School. This thesis incorporates the use of commercial-off-the-shelf linear programming tools to present and compare an alternative to the existing heuristic assignment methods. The results of this research found that by utilizing optimization techniques, the number of lieutenants who did not receive one of their first five choices could be decreased by an average of 66% and the average choice number assigned could be reduced from 2.9 to 2.1. The incorporation of e-commerce technology increased the return on knowledge associated with the MOS education process and presented the lieutenants with a consistent and familiar interface.

KEYWORDS: Optimization, Linear Programming, Database, Web Enabled, Internet, MOS, Marine Corps

AN ANALYSIS OF IMPLEMENTATION ISSUES FOR THE SEARCHABLE CONTENT OBJECT REFERENCE MODEL (SCORM) IN NAVY EDUCATION AND TRAINING

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The thesis research examines the emergence of Sharable Content Object Reference Model (SCORM) architecture currently under development by the Advanced Distributed Learning (ADL) initiative established by the Department of Defense (DoD). SCORM is a collection of specifications adapted from multiple sources to provide a comprehensive suite of E-learning capabilities that enable interoperability, accessibility, and reusability of Web-based learning content. To better understand the implementation issues of SCORM architecture, the authors analyze all versions of SCORM to understand the evolution of this emerging architecture. It contrasts the evolving requirements for shareable content objects with concerns of copyright issues. The authors address development and implementation issues surrounding the maturation of SCORM architecture and the ADL initiative. The authors recommend that DoD, international, and civilian business partners join in improving E-learning by embracing technology such as SCORM, which allows for shareable content objects to be used and reused within civilian and military education and training Learning Management Systems (LMS) across the World Wide Web.

KEYWORDS: Sharable Content Object Reference Model, SCORM, Advanced Distributed Learning Initiative, ADL, Distance Learning, E-learning

A DECISION SUPPORT SYSTEM FOR THE OPTIMAL DESIGN OF BASE-MOTION ISOLATORS

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Transient analysis of large structural systems is a computationally demanding process, which in the past has prevented dynamic redesign and optimization. Large structures, such as buildings or ships, subjected to random base motions use isolators to minimize strain energies, which may cause damage or structural failure. This research focuses on the optimization of isolator parameters in order for structural systems to withstand potentially catastrophic transient vibrations. Many non-linear hysteretic, viscoelastic, and sliding friction isolators were numerically modeled using the scientific programming language, MATLAB. The existing programs used to solve the Voltera integral formulation for Transient Structural Synthesis (TSS) and the Recursive Block-by-Block (RBB) algorithm were investigated and enhanced to yield greater accuracy and increased computational speed. The final product is a user-friendly Decision Support System (DSS) for use with both civil and military applications. Based on different types of base motions and the inherent dynamics of the structure, this Decision Support System (DSS) is capable of optimizing isolator parameters to meet a user specific objective.

KEYWORDS: Structural Dynamics, Structural Isolation, Nonlinear Transient Analysis, Structural Synthesis, Decision Support System, Recursive Block-by-Block, Convolution, Wen, Hysteresis, Earthquake

THE SECURITY ASPECTS OF WIRELESS LOCAL AREA NETWORK (WLAN)

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Wireless Local Area Networks (WLAN) are increasing in number in both home and business uses due to the convenience, mobility, and affordable prices for wireless devices. Wireless technology allows the mobile stations to freely move within the range of Access Points without being physically connected to the wired network. Ideally, the WLAN gives mobility and flexibility to users in homes and hot spot environments, such as airports and campuses.

However, WLANs have serious security problems because the wireless signal of the WLAN is broadcast through the air in all directions simultaneously. An unauthorized user can easily capture this signal using freeware tools to exploit WLAN vulnerability.

This thesis provides an introduction to WLAN technology, security vulnerabilities in the WLAN, and the recommended countermeasures for the Software Metrics Laboratory at the Naval Postgraduate School, with particular emphasis on security concerns for the implementation of the WLAN extension to the existing wired LAN.

KEYWORDS: Wireless Local Area Networks, WLAN, WIFI, 802.11b, Access Point, WLAN Security

A REALISTIC MODEL OF NETWORK SURVIVABILITY

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This thesis focuses on evaluating network survivability and Quality of Service (QoS) in a network. There have been studies on developing network survivability metrics: however, the implementation of these survivability measures is usually based on unrealistic assumptions. This thesis has some experiment results based on identifying all min-cuts of a network and computing survivability of the nodes based on these criteria.

The main contribution of the thesis is a novel approach to handling correlated or dependent component failures. In a complex network, it is not trivial to compute the probability of failures of the nodes even if the component failures are independent. With this new approach, network administrators could predict the optimal nodes in a network under more realistic conditions. Java-based simulation programs are developed to evaluate the approach. This project is motivated by network security problems in which a decision maker has to select nodes to host critical information servers when there is an attack to the network. The solution will give the decision makers criteria that would help them to make better decisions.

KEYWORDS: Network Survivability, Network Attacks, Max Flow, Min-cut, Probabilistic Networks, Modeling Dependent Nodes, Graph Algorithms, Bayesian

INTELLIGENT-AGENT-BASED MANAGEMENT OF HETEROGENOUS NETWORKS FOR THE ARMY ENTERPRISE

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The Army is undergoing a major realignment, in accordance with the Joint Vision 2010/2020 transformation, to establish an enterprise command that is the single authority to operate and manage the Army Enterprise Information Infrastructure (Infostructure). However, there are a number of critical network management issues that the Army will have to overcome before attaining the full capabilities to manage the full spectrum of Army networks at the enterprise level. The Army network environment consists of an excessive number of heterogeneous applications, systems, and network architectures that are incompatible. There are a number of legacy systems and proprietary platforms. Most of the NM architectures in the Army are based on traditional centralized NM approaches such as the Simple Network Management Protocol (SNMP). Although SNMP is the most pervasive protocol, it lacks the scalability, reliability, flexibility, and adaptability necessary to effectively support an enterprise network as large and complex as the Army. Attempting to scale these technologies to this magnitude can be extremely difficult and very costly. This thesis makes the argument that intelligent-agent-based technologies are a leading solution, among the other current technologies, to achieve the Army's enterprise network management goals.

KEYWORDS: Intelligent Agent, SNMP, Enterprise Network Management, CoABS, Army Enterprise Infostructure, Global Information Grid

AN ANALYSIS OF SYNERGIES OF IT-APPLICATIONS AND KNOWLEDGE MANAGEMENT STRATEGIES WITH REGARD TO ORGANIZATIONAL CHANGE

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The increasing complexity of political, regulatory, and technological changes confronting many commercial as well as non-profit organizations has made radical organizational change and adaptation a central research issue. Along with these research issues, a new awareness with regard to organization-internal existing knowledge and the necessity to exploit and mange this knowledge to the benefit of the organization has also arisen.

In an era of forth-coming new advanced information technologies on a nearly day-to-day basis and the increasing awareness and willingness to incorporate knowledge management strategies, organizational leaders and upper management have been increasingly craving a beneficial combination of the latter with their efforts to implement changes successfully within their organizations.

This thesis will analyze various organizational change strategies in order to provide a clearer understanding of the impact/influence of current IT-solutions exploiting existing knowledge within an organization to the benefits of successful organizational change efforts and strategies.

KEYWORDS: Knowledge Management, Organizational Change, Change Strategy, Explicit Knowledge, Tacit Knowledge, IT-application, IT-tools, Three-Ring-Perspective, Questionnaire

A COGNITIVE AND PEDAGOGICAL EVALUATION FRAMEWORK FOR COMPUTER-BASED TRAINING

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This thesis research examines the effectiveness of a newly developed cognitive and pedagogical evaluation framework to assess computer-based instruction. All training programs must have comprehensive evaluation guidelines in place to ensure the quality of instruction from the classroom-training environment to the virtual training environment is not diminished. The application of sound cognitive and pedagogical principles helps ensure that organizational training goals will be met. This research developed a set of practical guidelines, or a template, that should be used to evaluate the cognitive and pedagogical aspects of any given computer delivered course of instruction. This template is used to evaluate the United States Navy's newly developed CD-ROM Surface Warfare Officer (SWO) division officer training course. The SWO division officer course is the basic professional training for junior Ensigns that is now contained on CD-ROM and delivered by personal computer.

KEYWORDS: Computer-based Training, Computer-based Education, Distance Learning, Learning Theory, Multimedia, Instructional Evaluation, Cognitive and Pedagogical Evaluation

DESIGN OF AN EFFECTIVE VISUALIZATION FOR NAVAL CAREER INFORMATION SUMMARY AND EVALUATION

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By using visualization best practices and embedding them in information technology (IT), it is believed that the Department of Defense can improve its ability to display multi-variant information.

The focus of this research is to design a visual information solution, based on best practices for displaying performance data visually, to the Electronic Military Personnel Record System (EMPRS). Ultimately, the goal is to improve the overall effectiveness and objectivity of the Navy's selection board processes by providing a re-engineered, web–based, graphical solution to the visual displays currently in use by selection boards.

The current Navy selection board voting process uses tabular forms displayed across five screens in a small theater-like setting. The forms are displayed very quickly allowing board members very little time to mentally assimilate the quantitative data dispersed over a wide area. In this model, the data is distilled into a single graphical display, thus reducing the cognitive computing requirements of the board members.

The Knowledge Value Added methodology was used to determine the proposal's relative effectiveness and a prototype was developed as a proof of concept. With this study and follow on recommendations, a considerable improvement potential in the Navy's promotion board procedures and outcomes is forseen.

KEYWORDS: Naval Promotion, Visualization, Information System Technology, IST, Information Technology Management, ITM, Knowledge Value Added, KVA, Naval Postgraduate School, NPS, Naval Personnel Command, NPC

INFORMATION OPERATIONS IN STRATEGIC, OPERATIONAL, AND TACTICAL LEVELS OF WAR: A BALANCED SYSTEMATIC APPROACH

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This thesis explores the idea whether a balanced systematic approach is a better way to integrate Information Operations (IO) at different levels of war compared to uncoordinated efforts at each level. Analysis of the role of information in a conflict in the context of information superiority provides the foundation of the thesis. DOD's IO core, supporting, and related capability based approach was used in the analysis of each level of warfare. Strategic, operational, and tactical level IO were analyzed by matching relevant IO capabilities with the IO effects desired at the respective levels. Sample systems were provided for each capability when appropriate. IO efforts in Operation Desert Storm and Operation Allied Force were analyzed. This thesis concluded that a balanced systematic approach to IO through its integration at all three levels of warfare will produce much better results than the uncoordinated cases in order to exploit the integrative effect of IO on the instruments of national power and the military capabilities at different levels of warfare.

KEYWORDS: Information Operations, Information Superiority, Levels of Warfare, Operation Desert Storm, Operation Allied Force

DATA WAREHOUSING AT THE MARINE CORPS INSTITUTE

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This thesis is a case study on the value added of an implementation of a data warehouse at the Marine Corps Institute (MCI). Data Warehousing at an environment such as MCI can solve a myriad of strategic questions. The database which MCI possesses, the Marine Corps Institute Automated Information System (MCIAIS), contains a staggering amount of data, waiting to be mined and turned into knowledge for high-level decision makers. The actual value of the data warehouse to the organization is evaluated using the Knowledge Value Added (KVA) methodology. Many methodologies exist that attempt to measure the value added due to Information Technology. KVA allows the description of all process outputs, including those generated from IT in common units. This allows allocation of revenue to IT in proportion to contributions to process outputs at the sub-corporate level, which MCI is at. This thesis looks at warehouses, ways of measuring the value of IT, MCI's organization and core functionality, its current data environment, the implementation of the warehouse, and the value that is added through that implementation.

KEYWORDS: Knowledge Value Added, KVA, Data Warehouse, Return on IT, Data Mining, Database

THE FEASIBILITY OF WEB-ENABLED DIGITIZED VIDEO IN A LEARNING ENVIRONMENT

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Traditional methods of instruction limit a person's ability to gain required knowledge, yet many advanced technologies are not used. The potential knowledge acquisition is improved when digitally videotaping a course. Streamlining video over the Internet (wireless or hardwire), Digital Versatile Disc (DVD), Video Home System (VHS), and other modes of multi-media delivery, many of which are accomplished with little or no coordination, improve knowledge delivery systems.

The technology and flexibility provided by digitizing a course may be extremely beneficial and cost effective. In addition, if educators use methods of network, customer relations, and knowledge management to implement and to maintain processes, operations tend to run smoothly from start to finish.

Essentially, digitally videotaping a course makes it possible to disseminate lessons to facilities by accessing the Internet and providing that data to organizations with computer hardware and software, or simply store that data for future use. Adopting this method enables the product to be created efficiently and expeditiously. Whether at a university, a government installation, a civilian organization, or on a ship, by employing hardware and software to show digitized video, educators can disseminate courses to enhance the learning process in a timely and fairly inexpensive manner.

KEYWORDS: DVD, VHS, Digital Video, Streamlining Video, Internet, World Wide Web, Web-enabled Digitized Video in a Learning Environment

DRAG OPTIMIZATION OF LIGHT TRUCKS USING COMPUTATIONAL FLUID DYNAMICS

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There are 80 million light trucks on the road today with suboptimal aerodynamic forms. Previous research has found that several miles per gallon can be saved by specifically tailoring truck bodies for reduced aerodynamic drag. Even greater savings can be made if the shape of the trucks is numerically optimized. This could reduce fuel consumption in the United States by billions of gallons per year.

The purpose of this research is to develop and quantify optimal light truck canopy designs using computational fluid dynamics (CFD). Both two-dimensional and three-dimensional models are used to do this. Initially, this research focuses on quantifying and generalizing the effects of traditional automotive aerodynamic accessories, such as canopies and air dams. Once the effects of various form factors are quantified, an optimization of the canopy is performed. This thesis demonstrates a method for drag reduction using CFD and traditional numerical optimization techniques. Lastly, the optimized forms are physically constructed and their effects on fuel economy are compared to the CFD prediction.

KEYWORDS: Shape Optimization, CFD, Drag, Canopy, Air Dam, Light Truck, Miles Per Gallon, MPG, Fuel Efficiency, Fuel Economy